Cracking in Brittle Films on Ductile Substrates

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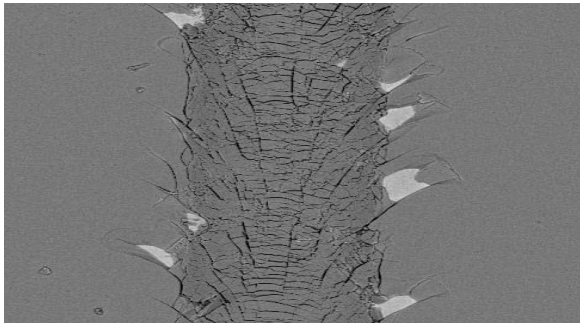
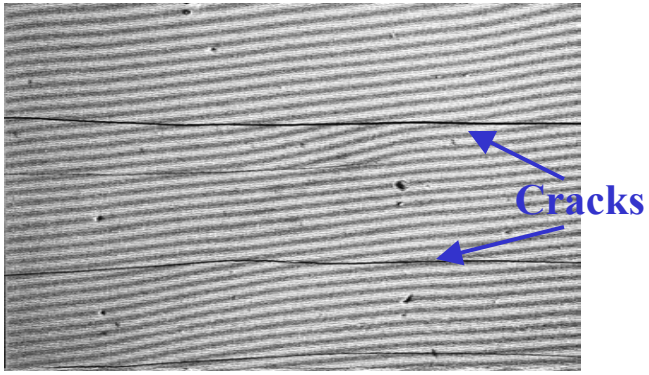
Hard surface films can protect materials from wear in applications ranging from dies for making coins to machine parts, but wear processes are not understood sufficiently well to design the best films. By making direct measurements of cracking behavior in brittle films using a novel technique called electron-beam moiré, it is possible to quantify film fracture. A team of graduate students, Ms. Saki Krishnamurthy, Ms. Kristin Galbally and Ms. Erin Justen, has captured cracks that channel across brittle chromium nitride films by pulling them in the electron microscope; they have shown how the film toughness and residual stress together determine the the wear resistance.

Looking on Top of Film:



Wear track in CrN film showing cracks.



Electron-beam moiré fringe pattern of a CrN coating being fractured. In between the dark lines labeled '*Cracks*', a new crack is channeling through the film from left to right.